

## II. REMARKS

The Office Action dated May 16, 2006, has been received and carefully noted. The amendments made herein and the following remarks are submitted as a full and complete response thereto.

Claims 1-7 are pending.

By this Amendment, claims 1, 4, and 7 are amended. Claim 5 is canceled. Support for the amendments are found in the specification and claims as originally filed. No new matter is added. For example, support for the amendment to claim 1 can be found in canceled claim 5, and in the specification on page 8, lines 2-7. Support for the amendment to claim 4 can be found in the specification on page 8, lines 5-6.

Claim 7 has been objected to as being of "improper dependent form for failing to further limit the subject matter of a previous claim" (Office Action, page 2, lines 6-7). Applicants believe that this objection has been overcome by the amendment to claim 7. As such, Applicants request reconsideration and withdrawal of the claim objection.

Claim 4 has been rejected under 35 U.S.C. §112, second paragraph, for the asserted indefiniteness. Applicants believe that this rejection has been overcome by the amendment to claim 4. As such, Applicants request reconsideration and withdrawal of the rejection of claim 4 under 35 U.S.C. § 112, second paragraph.

Claim 1, 2, 6, and 7 have been rejected under 35 U.S.C. § 102(b) over Japanese Patent No. 62-079289 (hereinafter "JP '289"). Applicants traverse the rejection. Further, Applicants enclose a document with an English translation of relevant portions of JP '289 (hereinafter "enclosed English translation").

Claim 1 of the present invention is directed to "[[a]] catalyst particle comprising an active metal and a carrier composed of a carbon material, wherein said active metal is supported by cavities formed on a surface of said carrier and their edge portions" (emphasis added). Meanwhile, claim 2 discloses that the "carrier comprises a mesophase carbon," and claim 6 discloses "wherein said active metal comprises Ru, Pt or an alloy thereof" (emphasis added). Applicants submit that the catalyst particle of the present invention "can firmly support the active metal for a long period of time, thereby stably showing a high catalytic activity, which is hardly reduced by the reaction" (specification, page 22, lines 5-10).

Further, Applicants note that the carrier of the presently claimed invention is obtained by two steps which allow for the formation of a "catalyst particle... [with] cavities having an average diameter of 0.5 to 5 nm formed on the surface of said carrier and their edge portions" (present claim 1). These steps are (1) preparation of easily graphitizable carbon powder, wherein "a granular mesophase pitch was infusibilized at 320°C for 10 minutes in airflow, and carbonized at 700°C for 1 hour in a nitrogen flow, to obtain a carbonized powder...", and (2) alkali activation treatment, wherein "resultant carbon powder and... an activator comprising KOH pellets and NaOH pellets... are put in a mortar and sufficiently mixed while grinding, and the resultant mixture was charged into an Inconel boat." Applicants note that the boat is placed in a tubular furnace, heated to 800°C at a heating rate of 200°C/hour in a nitrogen flow of 60 ml/minute, and kept at that temperature for 2 hours, and then the mixture is subjected to ultrasonic washing to remove KOH and NaOH (specification, page 17, line 14 to page 18, line 6).

In contrast, Applicants submit that JP '289 does not disclose the compound of the presently claimed invention, particularly a "catalyst particle... wherein said active metal is supported by cavities having an average diameter of 0.5 to 5 nm" (present claim 1) (emphasis added). Applicants submit that the JP '289 merely discloses a compound obtained by supporting a 0.01-40 wt. %, preferably 0.2 to 20 wt. %, "expressed in terms of simple metal, metal component, e.g. simply substance of copper, iron, Co, Ni, Rb, silver, Mo, Ru, Rh, lead, Pd, gold, mercury, platinum, Ta, etc., or oxide, halide, salt hydroxide, sulfide, etc., or combination thereof, on a carbonaceous mesophase material having preferably about 5 µm to 3 mm average particle diameter, e.g. mesocarbon microbeads of bulk mesophase carbon" (JP '289 abstract). JP '289 discloses that the compound is "readily producible and [is] used as an absorbent for a very small amount of radioactive iodine, etc., contained in waste water or [as a ] catalyst for various chemical reactions, etc." (JP '289 abstract).

Applicants submit that in JP '289 does not teach or suggest the particle of the presently claimed invention as JP '289 merely discloses that the carbonaceous mesophase materials used are obtained by a general method of producing mesocarbon microbeads, bulk mesobeads (bulk mesophase carbon), or the like. Specifically, JP '289 discloses that those mesocarbon microbeads or bulk mesobeads are obtained by aggregating the mesocarbon microbeads formed in a pitch matrix under a heat treatment at a temperature of about 350 to 500°C for about 0.5 to 10 hours in an inert circumstance to dissolving and dispersing at a room temperature or by heating in a solvent capably of selectively dissolving the pitch matrix such as pyridine, quinoline, nitrobenzene, etc., or a tar oil such as anthracent oil, creosote oil, petroleum aromatic

oil, etc. followed by filtrating thereof (enclosed English translation of page 2, left column, line 17 to right column, line 13 of JP '289) (emphasis added).

In other words, Applicants submit that JP '289 does not teach or suggest the catalyst particle of the presently claimed invention, particularly one wherein the active metal is supported by cavities having an average diameter of 0.5 to 5 nm.

For at least the above reasons, Applicants request reconsideration and withdrawal of the rejection of claims 1, 2, 6, and 7 under 35 U.S.C. § 102(b) over JP '289.

Claims 1 and 5-7 have been rejected under 35 U.S.C. § 102(e) over Romanenko et al. (U.S. Patent No. 6,753,290). Applicants traverse the rejection.

As mentioned above, the presently claimed invention is directed to a "catalyst particle comprising an active metal and a carrier... wherein said carrier has an average particle size of 0.01 to 10  $\mu\text{m}$ " (present claim 1) (emphasis added).

Applicants submit that Romanenko et al. merely discloses the use of a "catalyst composition comprising crystallites of catalytically active palladium or palladium and at least one metal of Group VIII of the Periodic Table of Elements." Applicants submit that Romanenko et al. discloses that the composition is applied to the surface of a carbon material, wherein the carbon material used is "a mesoporous graphite-like material with the average mesopore size in the range of from 40 to 400 Å [4 to 40 nm], the proportion of the mesopores in the total pore volume [being]... at least 0.5, and the degree of graphite similarity [being]... at least 20%" (Romanenko et al., col. 3, lines 48-56).

Further, Table 1 of Romanenko et al. discloses that the size of the carbon carriers is 3 to 6 mm (3000 to 6000  $\mu\text{m}$ ) (Romanenko et al., Table 11, col. 11 and 12).

In particular, the carbon porous carbon carriers disclosed by Romanenko et al. that are granules correspond are 2-5 mm (2000-5000  $\mu\text{m}$ ). As such, Applicants submit that Romanenko et al., which discloses carbon carriers that are 3000 to 6000  $\mu\text{m}$  in size, does not teach or suggest the catalyst particle of the presently claimed invention, which comprises a carbon carrier with an average particle size of 0.01 to 10  $\mu\text{m}$ .

For at least the above reasons, Applicants request reconsideration and withdrawal of the rejection of claims 1 and 5-7 under 35 U.S.C. § 102(e) over Romanenko et al.

Claims 1, 3, 6, and 7 have been rejected under 35 U.S.C. § 102(e) over Baker et al. (U.S. Patent No. 6,485,858). Applicants traverse the rejection.

As discussed above, the presently claimed invention is directed to a “catalyst particle comprising an active metal and a carrier..., wherein said active metal is supported by cavities having an average diameter of 0.5 to 5 nm” (present claim 1) (emphasis added).

Applicants submit that Baker et al. merely discloses a “fuel-cell electrode comprised of a dispersion of one or more noble metals, alloys or bimetallics thereof, on graphite nanofibers characterized as: a) comprised of graphite sheets... and b) having at least about 95% of their exposed surfaces comprised of edge regions” (Baker et al., col 2, lines 21-28) (emphasis added). Applicants submit that Baker et al. further discloses that the graphite nanofibers of Baker et al. possess structures in which the graphite sheets are aligned in a direction either substantially perpendicular, or substantially parallel to the fiber axis and designated “platelet” and “ribbon,” respectively. Further, Baker et al. discloses nanofibers which are characterized as

having: (i) a surface area from about 0.2 to 3000 m<sup>2</sup>/g, which surface area is determined by N<sub>2</sub> adsorption at -196°C; (ii) a crystallinity from about 50% to about 100%; (iii) interstices of about 0.335 nm to about 0.67 nm; and surfaces of the nanofiber that define the interstices, which surfaces have adsorption properties with respect to hydrogen, and the nanofibers thereof can also have widths from about 0.75 nm to about 1,000 nm (about 0.00075 μm to about 1 μm) (Baker et al., col. 3, lines 16-30).

However, Baker et al. does not teach or suggest a catalyst particle comprising cavities, let alone cavities having an average diameter of 0.5 to 5 nm formed on a surface of the carrier and the edge portions (present claim 1).

As Baker et al. does not teach or suggest all of the elements of the presently claimed invention, Applicants request reconsideration and withdrawal of the rejection of claims 1, 3, 6, and 7 under 35 U.S.C. § 102(e) over Baker et al.

Claims 1 and 4-7 have been rejected under 35 U.S.C. § 102(e) over Zhou et al. (U.S. Patent No. 6,746,597). Applicants traverse the rejection.

Applicants submit that Zhou et al. merely discloses “noble metal particles... deposited on carbon” and discloses that “[e]xamples of noble metal catalyst supports are activated carbon, carbon black, fluoridated carbon, alumina, bentonite, clay, diatomaceous earth, zeolite, silica, zirconia, magnesia, titania, and the like, and also mixtures of those” (Zhou et al., col. 5, lines 16-24) (emphasis added).

As admitted by the Examiner, Zhou et al. does not explicitly disclose a pore size from the porous support. Although Zhou et al. teaches a support material capable of supporting nanometer-sized crystal particles of the noble metal, Applicants submit that Zhou et al. does not teach or suggest a support material having cavities with an average

diameter of 0.5 to 5 nm formed on a surface of the support material and their edge portions. Further, Applicants submit that Zhou et al. does not teach or suggest a catalyst particle which comprises a carrier having an average particle size of 0.01 to 10  $\mu\text{m}$ .


As Zhou et al. fails to teach or suggest all of the elements of the presently claimed invention, Applicants request reconsideration and withdrawal of the rejection of claims 1 and 4-7 under 35 U.S.C. § 102(e) over Zhou et al.

III. **CONCLUSION**

Applicants respectfully submit that this application is in condition for allowance and such action is earnestly solicited. If the Examiner believes that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below to schedule a personal or telephone interview to discuss any remaining issues.

In the event this response is not timely filed, the Applicants hereby petition for an appropriate extension of time. The fee for this extension, along with any other additional fees which may be required with respect to this response, may be charged to Deposit Account No. 01-2300, referencing Attorney Docket No. **100347-00002**.

Respectfully submitted,

  
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Enclosure(s): English translation of relevant portions of JP '289  
Two (2) month Petition for Extension of Time